Rec'd PCT/PTO 11 JAN 2005

[Fig. 1]

1: vibration detection

2: CPU

3: current amplifier

4: base drive circuit

A1: command of position, speed, etc.

[Fig. 2]

11: speed control

A1: speed command

[Fig. 3]

A1: gain

A2: torque or speed

A3: time

[Fig. 4]

A1: movable range

[Fig. 5]

52: speed control

A1: position command

A2: load

[Fig. 6]

(i)

A1: command

A2: speed command

A3: speed

A4: torque

A5: vibration level during stopping

A6: time

(ii)

A4: torque

A6: time

A7: maximum amplitude

(iii)

A1: command

A2: speed command

A3: speed

A4: torque

A6: time

A8: gain

[Fig. 7]

A1: vibration during stopping

A2: Amplitude of torque

A3: speed loop gain

[Fig. 8]

1: detect amplitude level of torque during stopping

2: limited gain?

3: perform running such as acceleration

4: exceeds vibration level during stopping?

5: decrease controlled gain

6: determine as maximum gain

A1: gain adjustment

A2: increase controlled gain

A3: gain adjustment

A4: end

[Fig. 9]

A1: command

A2: speed command

A3: speed

A4: torque

A5: vibration level during running

A6: time

[Fig. 10]

A1: gain

A2: simulated disturbance torque

A3: torque, speed, etc.

A4: vibration detection level

A5: store limited gain (just before vibrates)

A6: time

[Fig.11]

1: detect vibration level of machine during normal running

2: add simulated disturbance torque

3: exceed vibration level

4: increase controlled gain

5: add simulated disturbance torque

6: exceeds vibration level

7: extraction of maximum gain,
decrease controlled gain

8: store control system and maximum gain

9: executed all the control systems ?

10: change control system

11: select control system with increased gain

A1: extraction of maximum gain

A2: increase simulated disturbance torque

A3: adjustment of simulated disturbance torque and vibration level

A4: extract maximum gain

A5: extract optimum control system

A6: end

[Fig. 12]

61: operator

2: CPU

3: current amplifier

4 base drive circuit

A1: man

A2: command of position, speed, etc.

A3: (sequence processing)

[Fig. 13]

1: move in movable range

2: increase

3: observe vibration → increase gain slightly if vibration occurs

4: fast move in movable range

5: confirm positioning in at normal speed

A1: exemplary sequence

[Fig. 14]

A1: gain

A2: torque, speed, etc

A3: time

[Fig. 15]

2: CPU

3: current amplifier

4: base drive circuit

A1: command of position, speed, etc.

[Fig. 16]

(i)

A1: command

A2: speed command

A3: speed

A4: time

(ii)

A1: command

A2: speed command

A3: speed

A4: time

A5: gain

[Fig. 17]

A1: command

A2: speed time

A3: speed

A4: time

A5: gain

図 1

Fig. 1

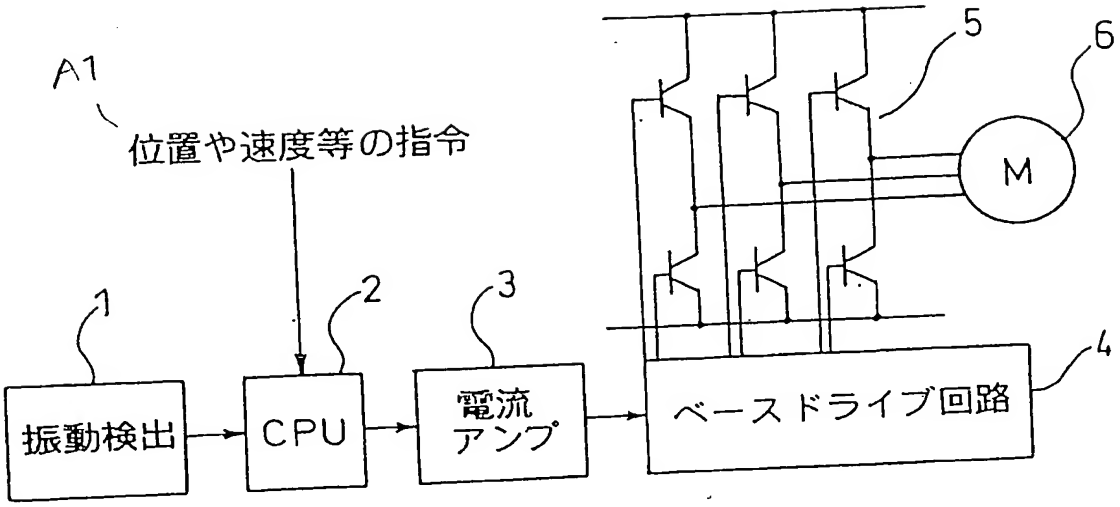


図 2

Fig. 2

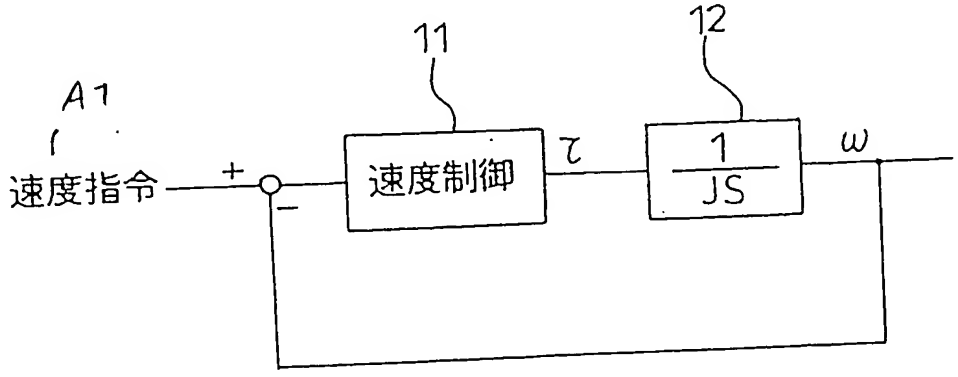


図 3

Fig. 3

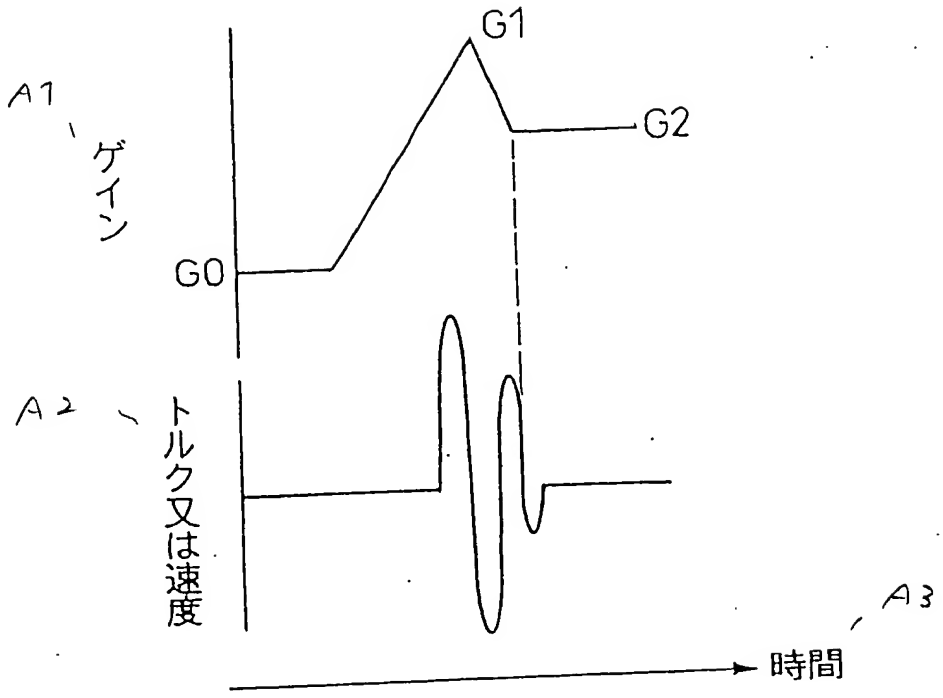


図 4

Fig. 4

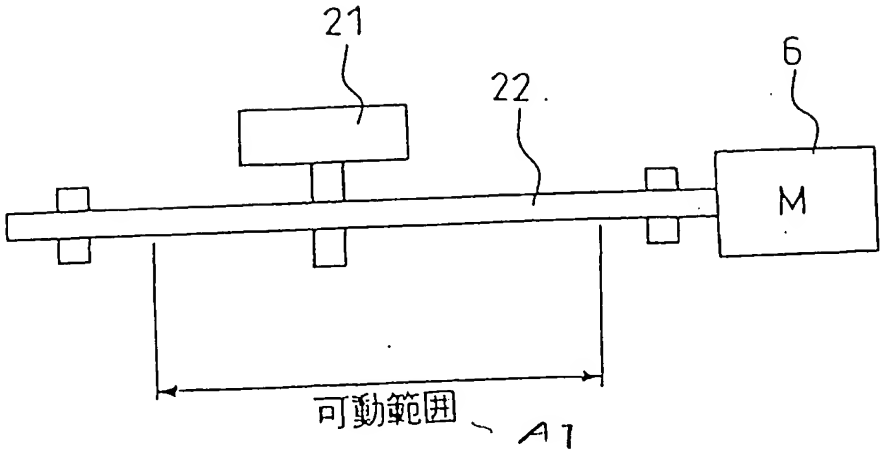


図 5

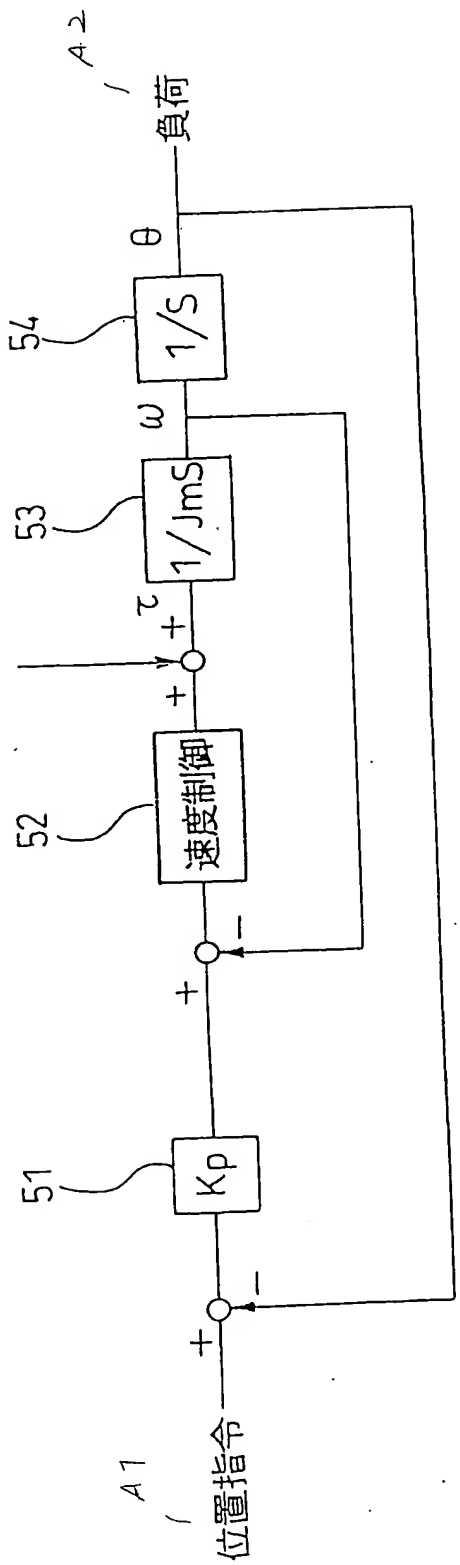


Fig.5

図 6

Fig. 6

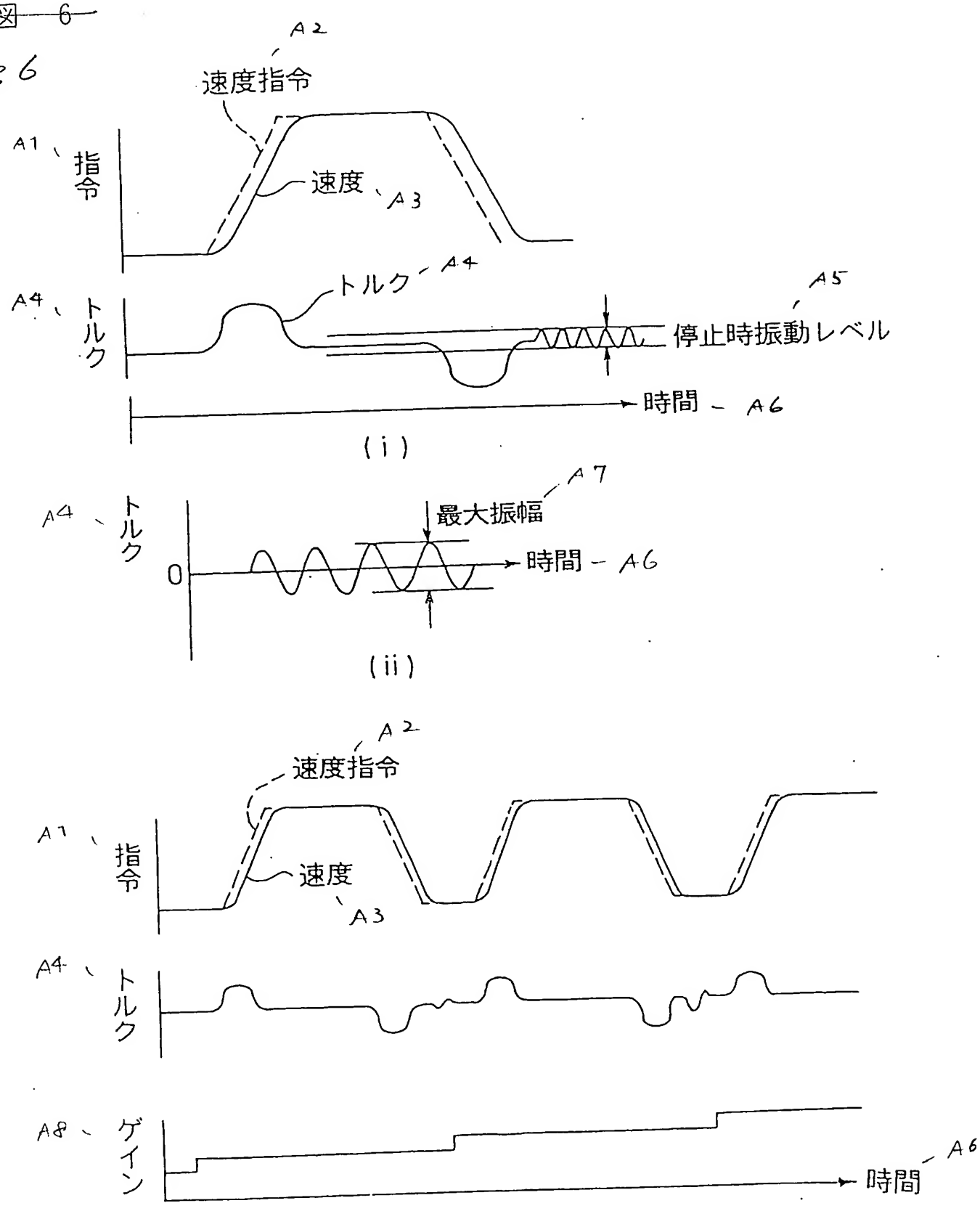

A2
速度指令
A1
指令
速度
A3
トルク
A4
A4
トルク
A5
停止時振動レベル
時間
A6
(i)
A7
最大振幅
A4
トルク
0
時間
A6
(ii)
A2
速度指令
A1
指令
速度
A3
A4
トルク
A8
ゲイン
A6
時間
(iii)

図 7

Fig. 7

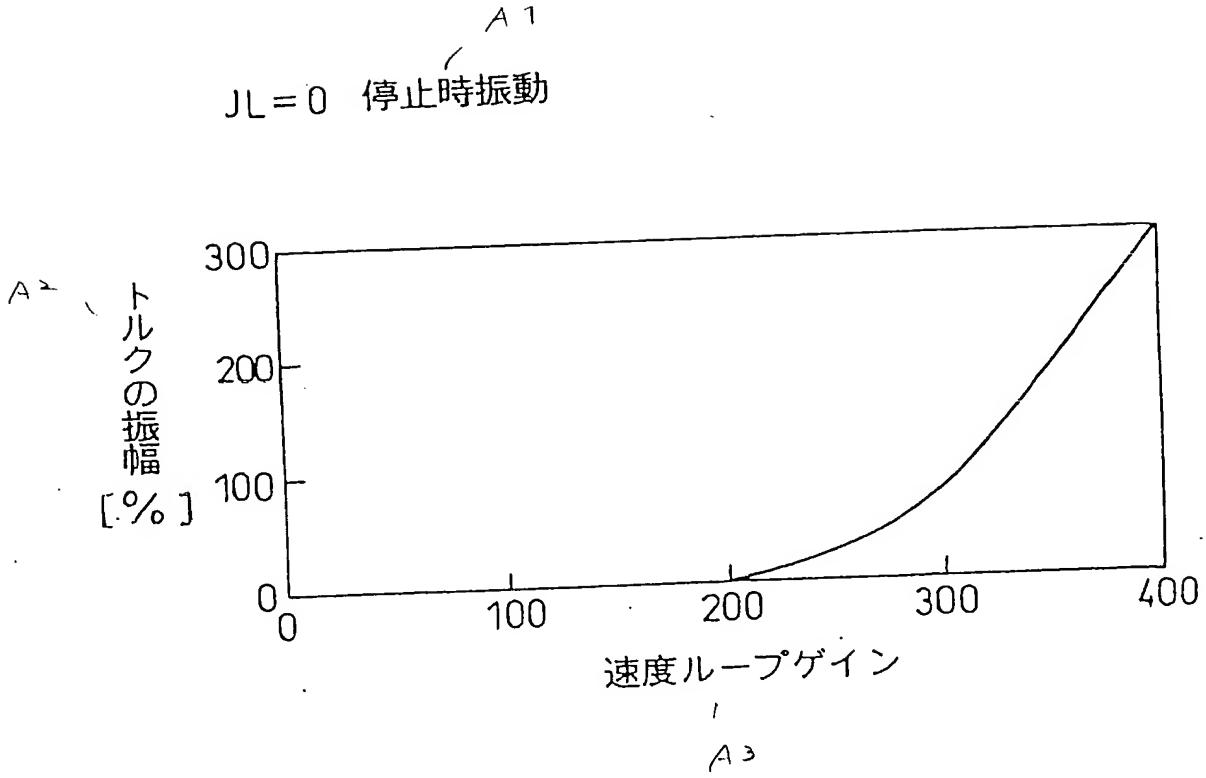

A1
JL=0 停止時振動
A2
トルクの振幅 [%]
300
200
100
0
0
100
200
300
400
速度ループゲイン
A3

図 8

Fig. 8

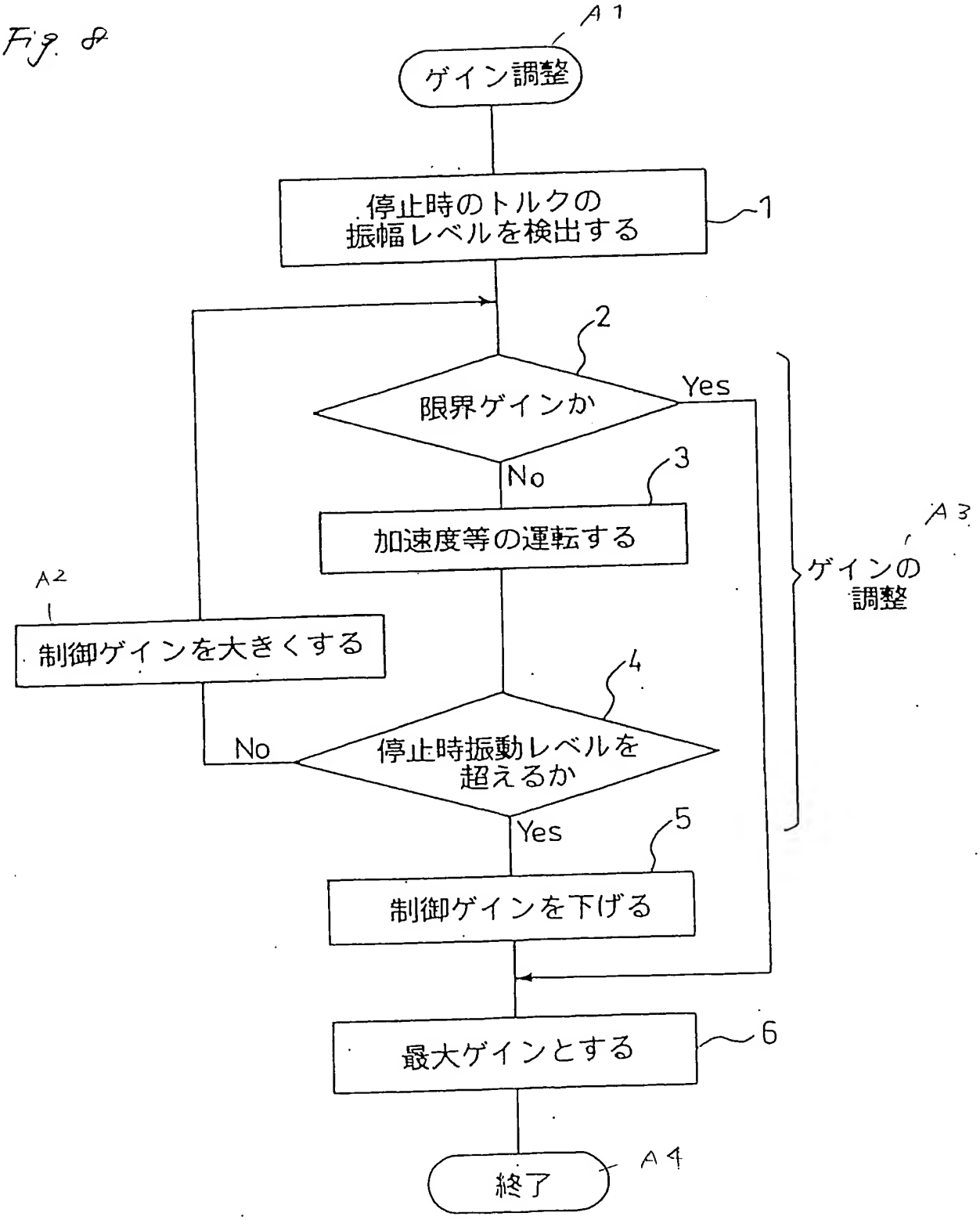

A1
ゲイン調整
停止時のトルクの
振幅レベルを検出する
1
2
限界ゲインか
Yes
No
3
加速度等の運転する
A3
ゲインの
調整
A2
1
制御ゲインを大きくする
4
No
停止時振動レベルを
超えるか
Yes
5
制御ゲインを下げる
最大ゲインとする
6
終了
A4

図 9

Fig. 9

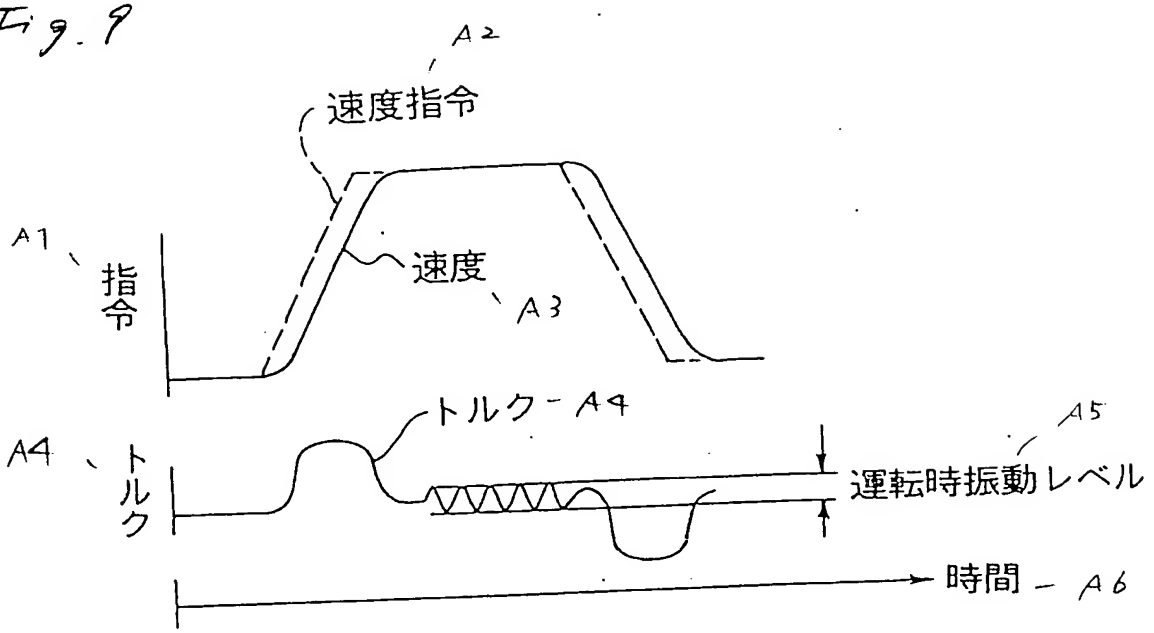
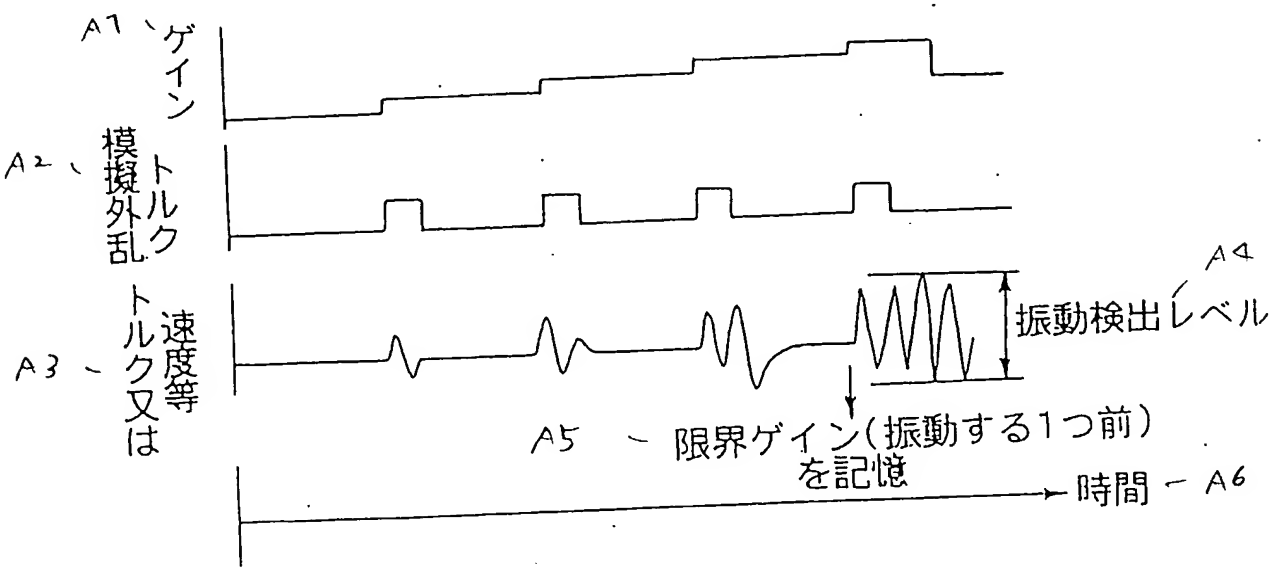


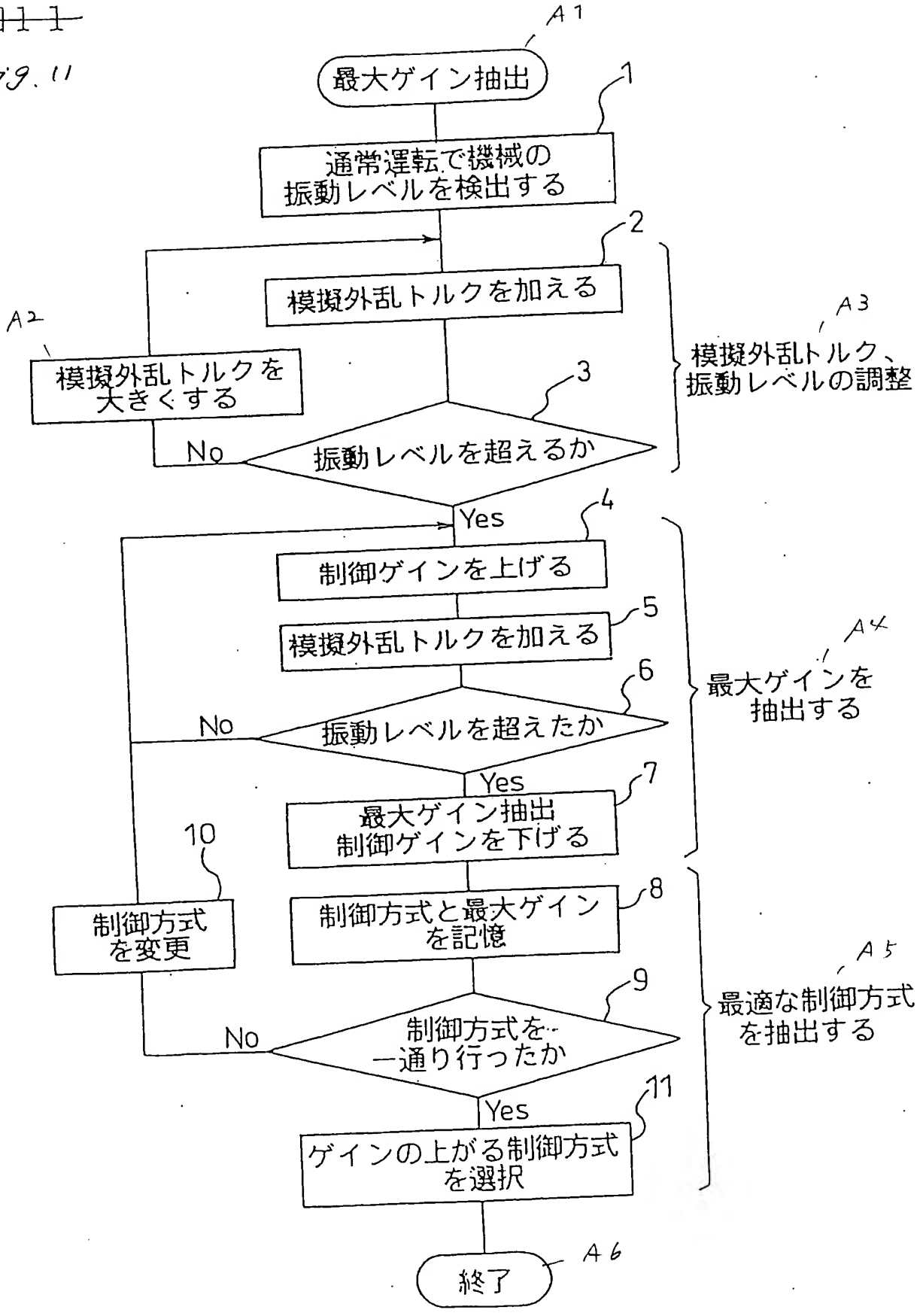
図 10

Fig. 10



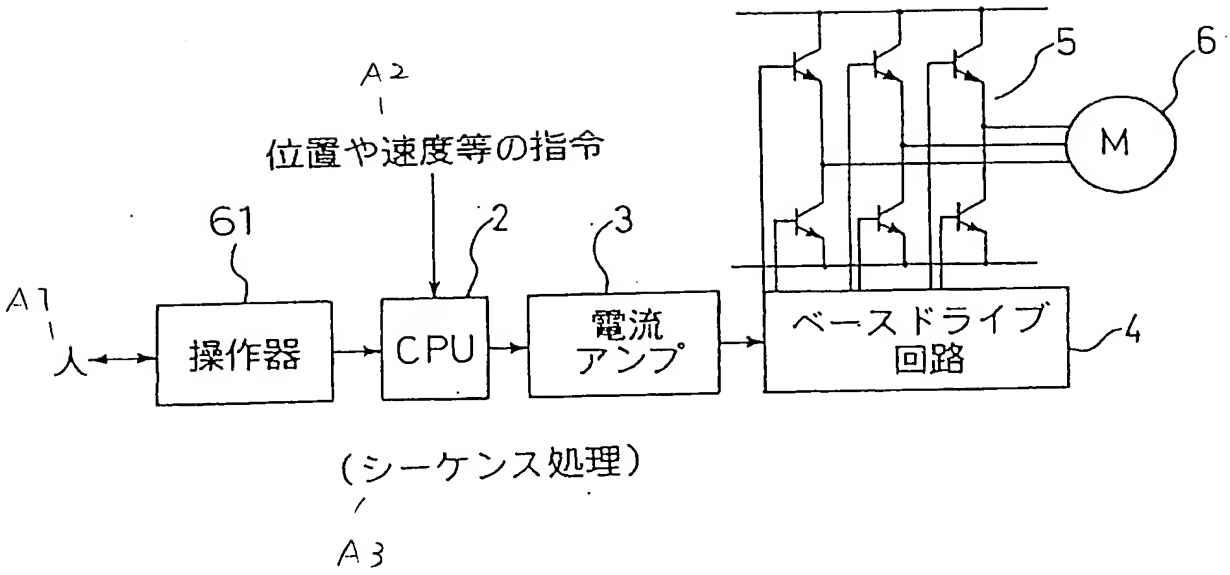
~~図11~~

Fig. 11


A1
最大ゲイン抽出
1
通常運転で機械の振動レベルを検出する
2
模擬外乱トルクを加える
A2
模擬外乱トルクを大きくする
3
No
振動レベルを超えるか
A3
模擬外乱トルク、振動レベルの調整
Yes
4
制御ゲインを上げる
5
模擬外乱トルクを加える
6
No
振動レベルを超えたか
A4
最大ゲインを抽出する
Yes
7
最大ゲイン抽出
制御ゲインを下げる
10
制御方式を変更
8
制御方式と最大ゲインを記憶
9
No
制御方式を一通り行ったか
A5
最適な制御方式を抽出する
Yes
11
ゲインの上がる制御方式を選択
A6
終了

~~図12~~

Fig. 12


A2
位置や速度等の指令
5
6
M
61
2
3
A1
人
操作器
CPU
電流
アンプ
ベースドライブ
回路
4
(シーケンス処理)
A3

~~図13~~

Fig. 13

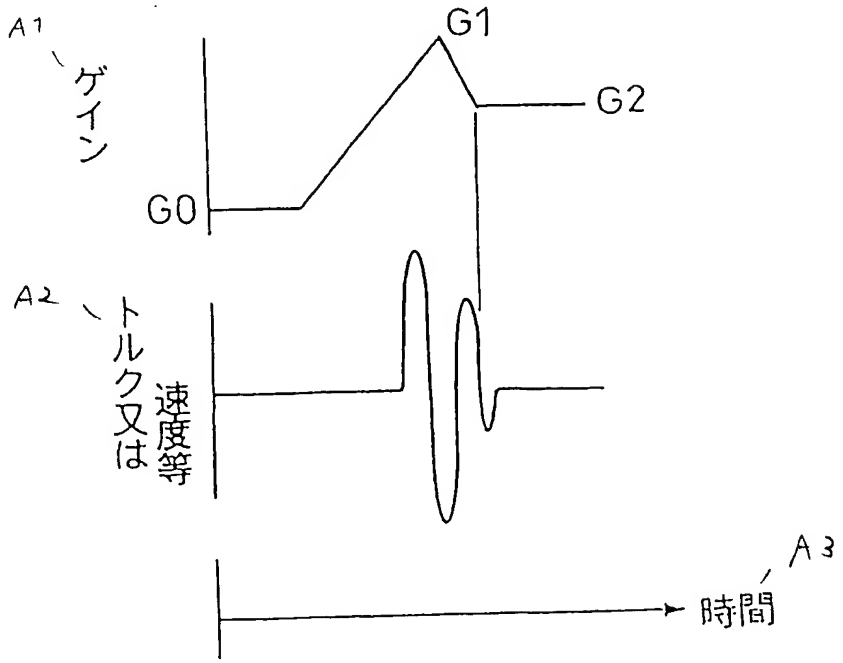
A1

シーケンス例

1.可動範囲を移動する。
2.ゲインを上げる。
3.振動を観測する。 → 振動したら少しゲインを下げる。
4.可動範囲を早送りする。
5.通常の速度で位置決めを確認する。
6.

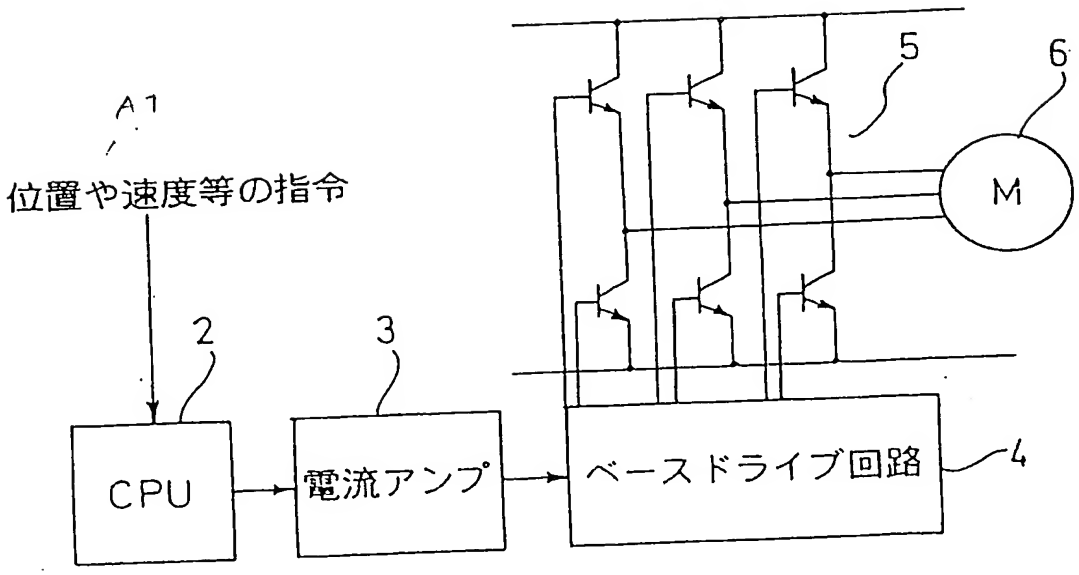
~~図14~~

Fig. 14



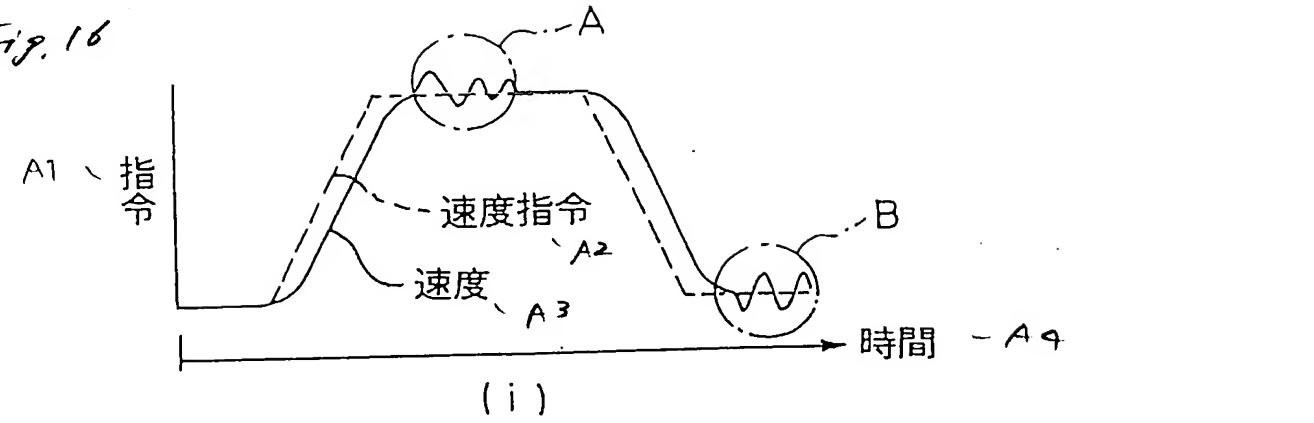
~~図15~~

Fig. 15

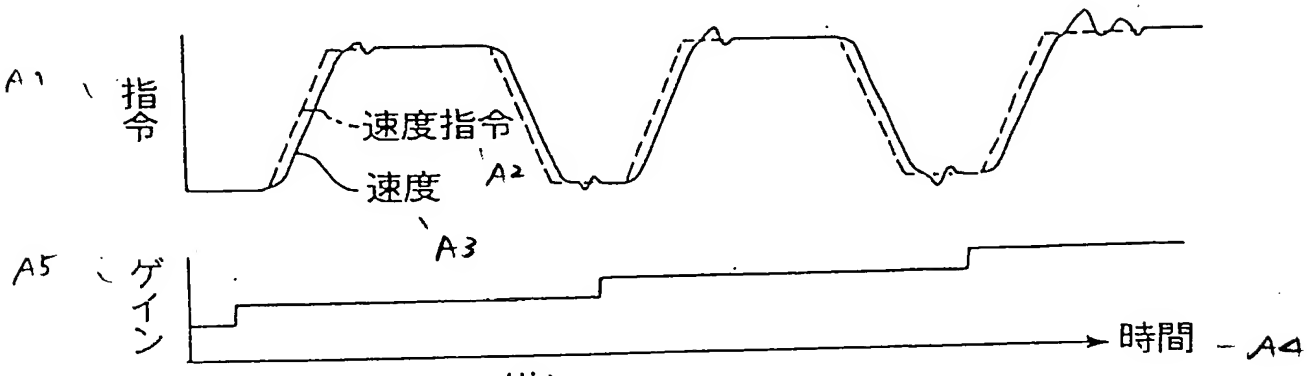


~~図16~~

Fig. 16



(i)



(ii)

~~図17~~

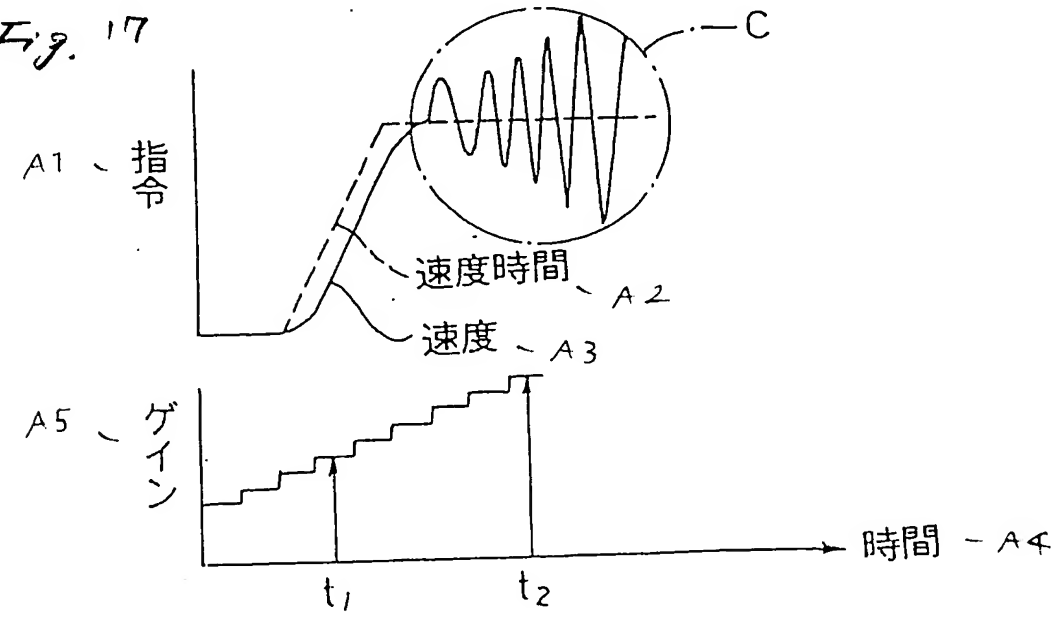



Fig. 17